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THE EFFECT OF ABNORMAL WEATHER CONDITIONS DURING 1934 ON
VEGETATION IN THE NORTHEAST

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in the Northeast

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It is generally known that the range of a given species is determined chiefly by climate. Toumey 3/ states that "the northern limit of a species is in part an isotherm beyond which it can not exist because of winter killing and frequent injury from early and late frosts." The subnormal temperatures which prevailed throughout the region during February and March 1934, offered an opportunity for studying their effect upon vegetation in the Northeast. Accordingly, various individuals and agencies were requested to report any unusual damage to vegetation which might have been caused by adverse weather conditions.

January was relatively mild throughout the region. 4/ There was also a marked deficiency of snowfall for the month. February was subnormally cold. It was the coldest month for New England since records have been compiled and was the coldest month recorded in New York since 1890. The average temperatures for February in New England and New York were 10.7 and 12.4 degrees below normal respectively. Heavy snow fell over New England and eastern and southern New York in February.

Rainfall was below normal in May in northern New England and drought conditions prevailed over most of New England during July and August. The greatest drought conditions occurred along the coast, being very marked in southern Rhode Island and on Cape Cod, where the precipitation deficit for these months was over 60 percent. Drought conditions in northern and western New York prevailed from May to September. At Olean, in southwestern New York, September was the only month in which a precipitation deficit did not occur. The deficit at this point for the period of May - August was 49 percent.

1/ Acknowledgement is due to cooperators in Civilian Conservation Corps, Forest Schools, State Forestry Departments, and others who have supplied observations on which this paper is based. The list of cooperators is too large for individual acknowledgment.

2/ Maintained at New Haven, Connecticut, in cooperation with Yale University.

3/ Toumey, James W. Foundations of silviculture upon an ecological basis. Volume 1. John Wiley & Sons, New York, 1928.

4/ Weather data obtained from "Climatological Data" Annual Summary 1934. Vol. 46:13. New England and New York Sections, U. S. Weather Bureau.

Both sassafras (Sassafras variifolium) and spice bush (Benzoin aestivale) were severely winter damaged in several central New York localities. Since the occurrence of both species in those localities is sporadic rather than general, winter killing might be an important factor in limiting the northern extension of the ranges of these species.

Winter damage to ornamental and fruit plants in some localities was estimated to have amounted to thousands of dollars. A thousand acre stand of immature northern hardwoods in the Adirondacks near Cranberry Lake, New York, was so severely damaged that the area appeared to have been burned. Such losses were not general in all districts, for plants that were injured in a given locality were not harmed in nearby localities. Vegetation in open or in exposed places, or which was planted within a year was damaged more than the vegetation in sheltered places, or which was planted prior to 1933.

Mr. DeForest A Matteson of the Allegany State Park Commission, Red House, New York, writes, "During the extreme cold weather the following phenomenon was observed several times: After an extreme low temperature, with no wind, sky clear, but air generally hazy, the rising sun striking the east slope would cause a barrage of snapping, cracking, and booming in the timber. This would last for a short time only, I can not say exactly how long, perhaps fifteen minutes to a half hour. Some of the reports were very sharp and loud. I assume this to be frost cracking of the timber, but can not just explain the part played by the sun's rays. The temperature was well below zero."

During July many exotic shrubs in southwestern New York continued to die. Whether this mortality was due to winter injury, frost, or drought, or their combined effects, is not known.

Effects of Individual Weather Injuries

The observations received at the Northeastern Forest Experiment Station on the injurious effects of frost, drought, and the winter of 1933-34 are summarized as follows:

Frost

The excessive cracking of the boles of young aspen (Populus tremuloides) in northwestern Massachusetts may have been due to the low temperatures in the spring.

In eastern Massachusetts frost injury in small valley-like depressions retarded vegetative activity to such an extent that the appearance of leaves and catkins, especially of bear oak (Quercus ilicifolia), was from a week to ten days later than on the surrounding ridges.

Many privet (Ligustrum vulgare) hedges were killed in northern Massachusetts during a period (May 8-12) of exceedingly cold days and nights in which temperatures fell well below freezing.

A severe frost on May 16 in southwestern New York killed many leaves and new shoots of beech (Fagus grandifolia), white ash (Fraxinus americana), shagbark hickory (Hicoria ovata), mountain laurel (Kalmia latifolia), and black locust (Robinia pseudoacacia).

Many new shoots and leaves of Viburnum (Viburnum sp.) were killed by a heavy frost on May 24 in northern New York.

On June 7, a killing frost at Newcomb, New York, did considerable damage to yellow birch (Betula lutea), beech, and bracken fern (Pteris aquilina).

Drought

Summer drought at Thomaston, Conn., is believed to have caused premature ripening, dissemination, and poor quality of the seed of shagbark hickory, and butternut (Juglans cinera).

Premature leaf falling from aspen (Populus tremuloides) on southern exposures in sections of the Adirondacks may have been due to drought. In August some aspens lost as much as 50 percent of their foliage which turned yellow and fell as naturally as did the rest later.

Winter Killing

Abies balsamea (Balsam fir): The foliage of trees along roadsides and in low, damp places in south central Vermont browned in March. Considerable winter killing occurred in sections of the Adirondacks (northern New York) and in south central New Hampshire.

Acer palmatum (Japanese maple) suffered considerable injury in northwestern Connecticut.

Acer rubrum (Red maple) was winter killed to some extent in north central Maine where the flowers dropped off before any fruit was formed. Sapling stands on old burns were killed in the Adirondacks. The damage was so severe in one stand near Tupper Lake, New York, that sprouts resulting from root crowns and stems gave a most striking appearance to the stand. Immature trees were severely damaged at Cranberry Lake, New York.

The low temperatures during the spring are believed to have caused an excessive cracking of the boles of young trees in northwestern Massachusetts.

Acer saccharum (Sugar maple): Although this phenomenon may not have been due to the weather, it is interesting to note that in northwestern Massachusetts a barrel of sap produced one gallon of maple syrup instead of two-thirds of one gallon as is usual.

Alnus sp. Many alder clumps in southwestern New York were severely injured or killed.

Amygdalus persica (Peach). Many peach trees in central and southern New England did not bloom at all, and the fruit crop in general was a failure.

Benzoin aestivale (Spice bush) was killed back to the ground in several localities in central New York. This species did not bloom at all at Mount McGregor, New York, in the southeastern Adirondacks.

Betula lutea (Yellow birch) was severely damaged at Cranberry Lake, New York.

Betula papyrifera (Paper birch): the branches of paper birch were badly damaged by snow and wind on certain areas in northwestern Massachusetts.

Catalpa bignonioides (Catalpa) was occasionally killed in northwestern Connecticut.

Cypripedium hirsutum (Show lady's slipper) which had been transplanted at Mount McGregor, New York, did not come above the ground.

Delphinium sp. (Larkspur) was winterkilled in north central Massachusetts.

Digitalis purpurea (Foxglove) was occasionally winterkilled in north central Massachusetts.

Fagus grandifolia (Beech) Winter killing is believed to have been the reason for the failure of the lower branches of beech to leaf in certain sections in central New York. Mature beech at edges of clearings were winter killed in some Adirondack localities. At Cranberry Lake, New York, this species was injured more severely than others, some trees as large as 18 inches D.B.H. being damaged.

Forsythia sp. Although not killed at Mount McGregor, New York, the Forsythia failed to bloom.

Habenaria fimbriata (Fringed orchis) was badly damaged at Mount McGregor, New York.

Kalmia latifolia (Mountain laurel) was damaged to a slight extent in northwestern Connecticut and north central Massachusetts.

Larix laricina (Tamarack) that were directly exposed to the prevailing winds were killed in some localities of northwestern Massachusetts.

Ligustrum vulgare (Privet) was winter killed in southern and northwestern Connecticut, central Massachusetts, and southeastern New York.

Malus sylvestris (Cultivated apple). Some old apple trees which were in an exposed spot and which had been pruned, were winter killed in a locality in western Massachusetts. Baldwin apple trees were severely

injured in southeastern New York. Orchards within a radius of fifty miles of Mount McGregor in the southeastern Adirondacks looked as if fire had swept through them. In southwestern New York, where the damage was greatest when exposed to the wind, many trees did not leaf out at all.

Picea excelsa (Norway spruce). In northwestern Massachusetts one 20 acre plantation established in 1933 on an exposed northwest slope was 85 percent winter killed. In the same locality snow and wind also damaged older plantations which were not sheltered from the prevailing winds. At Sharon in central Vermont, the leaves on the south side and above the snow line on many Norway spruce four feet high browned and fell.

Picea pungens (Colorado blue spruce) was not damaged in the nursery of the Brown Company in western Maine, although native species in the nursery were severely injured.

Picea rubra (Red spruce) plantations in northwestern Massachusetts were damaged by snow and wind. Winter killing of nursery stock was severe in western Maine. Some winter killing also occurred in south central New Hampshire, in the Adirondacks and in exposed places in central Vermont.

Picea sitchensis (Sitka spruce) was killed in southeastern New York.

Pinus austriaca (Austrian pine) plantations which were not sheltered from the prevailing winds were damaged by snow and wind in northwestern Massachusetts.

Pinus banksiana (Jack pine). Two spot plantings in northwestern Massachusetts were damaged by heavy snowfall which bent the trees a foot or so above the snow line.

Pinus resinosa (Norway pine) plantations established in 1933 in a section of northwestern Connecticut were winter killed. Nursery stock was severely damaged in western Maine.

Pinus strobus (Northern white pine) was winter killed in north central Massachusetts, some sections of southern New York and along roads in sections of central Vermont. In some sections of north central Maine the 1933 needles and clusters of terminal buds on the leaders of 5 to 15 year old trees were killed, and growth frequently resulted from adventitious buds formed below the dead portions of the leaders. Similar damage occurred to native and plantation trees in sections of northwestern Massachusetts. White Pine was the least affected of any species at Newcomb, New York, in the Adirondacks.

Pinus sylvestris (Scotch pine) was slightly winter killed in sections of central Vermont.

Populus tremuloides (Aspen) branches were damaged by snow and wind in northwestern Massachusetts.

Pseudotsuga taxifolia (Douglas fir). Many trees from 8 to 20 feet tall in a one-half acre plantation in central Vermont were killed.

Quercus borealis (Red oak) on tops of ledges in west central Connecticut were killed. "Flux run" (running of sap from cracks in the bark) occurred in some trees in western Massachusetts.

Quercus ilicifolia (Bear oak or scrub oak) on ledges in west central Connecticut were killed.

Quercus montana (Chestnut oak) on tops of ledges in west central Connecticut were winter killed.

Rhododendron sp. Rhododendron suffered considerable winter damage in northwestern Connecticut.

Rhus hirta (Staghorn sumac) was badly damaged, and in some cases killed by the severe winter in central New York.

Rosa sp. (Rose), many of which withstood the rigor of previous winters, were winter killed in central Massachusetts, southern and northern New York. The sweet briar variety was badly damaged in the southeastern Adirondack district. The semi-naturalized R. cinnamomea (?) suffered less injury than other varieties in southwestern New York.

Sassafras varifolium (Sassafras) suffered considerable winter killing in several central New York localities.

Tulipa sp. (Tulip) was entirely killed in some localities in central Massachusetts.

Tsuga canadensis (Eastern hemlock) suffered needle damage in localities in central and western Massachusetts, southern New York, and central Vermont. Most of the damage occurred to portions of the trees which were exposed to the sun and wind. At Newcomb, New York, in the Adirondacks, hemlock suffered more from this type of winter killing than any other species.

Ulmus americana (American elm) was winter killed in north central Maine.

Vaccinium sp. (Cranberries). Ice to a thickness of two feet in cranberry bogs caused a total loss of cranberries in some localities in south central Connecticut.

_____ (Blueberries) were killed back to the root crowns in some Adirondack communities.